18 HAIR

18.1 Introduction to Hair

18.1.1 Objectives

Through completion of this module the trainee will develop the theoretical knowledge to be conversant in:

- The history and use of hair examinations; and,
- Hair terminology.

18.1.2 Required Readings

18.1.2.1 Bisbing, Richard E., "The Forensic Identification and Association of Human Hair", Saferstein, Richard, ed., Forensic Science Handbook, Volume 1, 2nd ed., Pearson Education, Inc., Upper Saddle River, NJ, 2002, pp. 389-428.

18.1.2.2 Petraco, N. and Frass, C., "Morphology and Evidential Significance of Human Hair Roots", *Journal of Forensic Sciences*, Vol. 33, 1988, pp. 68-76.

18.1.2.3 Presley, Lawrence A. and Hensley, Kathryn W., "A Historical Review of Forensic Hair Comparisons", Federal Bureau of Investigation, Publication #88-01.

18.1.3 Questions

The trainee will provide written answers to the following questions:

- Who were some of the pioneers in hair examination?
- What contribution did the pioneers make?
- Define the following:
  - Anagen
  - Body hair
  - Catagen
  - Common featureless hair
  - Cortex
  - Cortical fusi
  - Follicle
  - Fur hairs
  - Guard hairs
  - Keratin
  - Limb hair
  - Medulla
  - Melanin
  - Ovoid bodies
  - Papilla
  - Pigment granules
  - Putrid root
  - Scales
  - Tactile hairs
  - Telogen
  - Transitional hair
  - Vellus hair

18.1.4 Evaluation

18.1.4.1 The trainer will review the written answers to the questions with the trainee.

18.1.4.2 The trainer and the trainee will review and discuss the pertinent points of each of the required readings.

18.1.4.3 The trainee will be quizzed orally upon the subject matter.

18.2 Recognition, Collection, Packaging and Controls

18.2.1 Objectives

Through completion of this module the trainee will have developed and demonstrated theoretical knowledge and/or practical skills to:

- Collect hair and fiber evidence;
- Describe to an investigator the proper way to collect hair evidence;
- Recommend proper packaging for hair evidence;
- Detail the proper controls that are to be taken and why; and,
- Describe the contents of a Virginia DFS PERK kit.

18.2.2 Required Readings

18.2.2.1 Palenik, Skip, "Microscopy and Microchemistry of Physical Evidence", Saferstein, R., Volume II, Prentice Hall, Englewood Cliffs, NJ, 1988, pp. 161-168.

18.2.2.2 Virginia Division of Forensic Science Evidence Handling Guide.

18.2.3 Questions

The trainee will provide written answers to the following questions:

- What knowns and controls are to be collected?
- How are knowns and controls to be collected?

18.2.4 Practical Exercises

18.2.4.1 Demonstrate the druggist or paper fold to the trainer.

18.2.4.2 Describe proper measures to avoid body fluid and hair/fiber contamination of evidence.

18.2.4.3 Explain to the trainer the information you would give an officer for recognition, collection and packaging of hair evidence.

18.2.5 Evaluation

18.2.5.1 The trainer will review the written answers to the questions with the trainee.

18.2.5.2 The trainer and the trainee will review and discuss the pertinent points of each of the required readings.

18.2.5.3 Review of practical exercises.

18.3 Stereomicroscopic evaluation, Microscopic examination and Microscopic comparison

18.3.1 Objectives

Through completion of this module the trainee will have developed and demonstrated theoretical knowledge and/or practical skills to:

- Identify animal hairs;
- Identify race and somatic origin of hairs;
- Distinguish animal hairs from human hairs;
- Prepare temporary and permanent microscopic slides of hairs;
- Perform human hair comparisons as internal support;
- Evaluate hairs for nDNA and mtDNA analysis;
- Determine the physical properties of hairs to include: color, texture, thickness, and other characteristics;
- Use a stereomicroscope properly; and,
- Use a comparison microscope properly.

18.3.2 Required Readings

18.3.2.1 Appleyard, H.M., Guide to the Identification of Animal Fibers; Wool Industries Research Association: Leeds, England, 1978.

18.3.2.2 Brunner, H. and Coman, B., The Identification of Mammalian Hair, Inkate Press Proprietary Ltd., Melbourne, 1974.

18.3.2.3 Gaudette, B.D., and Keeping, E.S. , "An Attempt at Determining Probabilities in Human Scalp Hair Comparison", *Journal of Forensic Sciences*, July 1974, pp. 599-606.

18.3.2.4 Hicks, John, Microscopy of Hairs: A Practical Guide and Manual, Federal Bureau of Investigation, U.S. Government Printing Office, Washington, D.C., January 1977.

18.3.2.5 Houck, M. M. and Budowle, B., "Correlation of Microscopic and Mitochondrial DNA Hair Comparisons", *Journal of Forensic Sciences*, Vol. 47, No. 5, 2002, pp. 964-967.

18.3.2.5 Kirk, Paul L., Crime Investigation,, Interscience Publishers, Inc., New York, 1953, pp. 650-651.

18.3.2.6 Kirk, Paul L., "Human Hair Studies-General Considerations of Hair Individualization and its Forensic Importance", *Journal of Criminal Law and Criminology*, Vol. 31, 1941, pp. 486-496.

18.3.2.7 Linch, C.A., Smith, S.L. and Prahlow, J.A., "Evaluation of the Human Hair for DNA Typing Subsequent to Microscopic Comparison", *Journal of Forensic Sciences*, Vol. 43, No. 2, 1998, pp. 305-314.

18.3.2.8 Linch, C.A. and Prahlow, J.A., "Postmortem Microscopic Changes Observed at the Human Head Hair Proximal End", *Journal of Forensic Sciences*, Vol. 46, No. 1, 2001, pp. 15-20.

18.3.2.9 Moenssens, Andre A., Ray E. Mosses and Fred E. Inbau, Scientific Evidence in Criminal Cases, 3rd ed., The Foundation Press Inc., Mineola, New York, 1986, pp. 475-495.

18.3.2.10 Wildman, A.B., "The Identification of Animal Fibers", *J. Forensic Science Society*, Vol. 1, No. 2, 1961, pp. 1-8.

18.3.3 Questions

The trainee will provide written answers to the following questions:

- List some of the obvious differences between human hairs, animal hairs and fibers.
- Can the race or somatic origin of hair always be determined? Explain.

- Are fur hairs or guard hairs more important for species determination of animal hairs?
- Human hairs from which two somatic regions are used for human hair comparisons?
- Give examples of instances where false exclusion or false inclusion may occur.
- Sketch and label a human head hair to include shaft and root portion.
- Sketch the human growth cycles indicating which root forms are suitable for referral for nDNA analysis.

18.3.4 Practical Exercises

18.3.4.1 The trainer will discuss with the trainee how to take appropriate notes, how to properly use worksheets and what abbreviations are in standard use for hair analysis.

18.3.4.2 The trainer will demonstrate the recovery of hairs and/or fibers from a variety of textile materials or other objects.

18.3.4.3 The trainer will demonstrate/discuss color, texture, thickness and other hair characteristics using the stereomicroscope. Synthetic and natural fibers will also be included.

18.3.4.4 The trainer will demonstrate and the trainee will practice cross-sectioning of hairs.

18.3.4.5 The trainer will demonstrate and the trainee will practice preparing scale casts of hairs.

18.3.4.6 The trainer will demonstrate/discuss microscopic characteristics and their value in hair comparisons using the comparison microscope, correlating the features viewed with those observed using the stereomicroscope as appropriate. Synthetic and natural fibers will also be included.

18.3.4.6.1 The microscopic hair characteristics will include, but not be limited to, color, texture, thickness, medullation, pigment, cross-section, growth stage, damage and artifacts.

18.3.4.7 The trainer will provide reference samples for the trainee to examine using the stereomicroscope and the comparison microscope. Synthetic and natural fibers will also be included. The trainee will record their observations.

18.3.4.8 The trainee will be provided with a series of training sets to assist in determining their ability to correctly assess:

- Hairs versus fibers
- Human versus animal origin, to include species of animal hairs
- Race of human hairs
- Somatic origin of human hairs
- Suitability of human hairs for meaningful microscopic comparison purposes
- Suitability of human hairs for nuclear DNA (PCR) typing

18.3.4.9 Once the trainee has demonstrated their ability to successfully evaluate the exercises from 18.3.4.8, the trainee will be given a minimum of ten training sets where they will compare human hairs. At least three of these training sets will include the recovery of hairs from different items.

18.3.4.10 The trainee will also receive a few animal hair comparison tests.

18.3.5 Evaluation

18.3.5.1 The trainer will review written questions with the trainee.

18.3.5.2 The trainer and the trainee will review and discuss the pertinent points of each of the required readings.

18.3.5.3 Review of practical exercises.

18.4 Supervised Casework

The trainee will work at least twenty forensic cases as a technician for a qualified hair examiner. The trainer should ensure as much variety in the casework as is practicable.

18.5 Forensic Significance of Hair

The trainer and the trainee will discuss the interpretation of hair evidence and its relevance and weight in reports and in testimony.

18.6 Report Writing

The trainer will review and discuss with the trainee the standard report wording in Section 11.9 of the Trace Evidence Standard Operating Procedures.

The trainer will provide ten cases previously examined by other qualified hair examiners for the trainee to review and discuss with the trainer.

The trainee will draft wording for both internal and external reporting as a part of the analysis of their training sets as well as when performing supervised casework.

Report writing will be evaluated throughout the training period by the trainer.

18.7 Hair Presentation and Oral Examination

The trainee will prepare a presentation of approximately 20-30 minutes in length which they will present to a group consisting of qualified trace evidence examiners, the QA Coordinator, as available, and any Director that chooses to attend. The presentation may cover either: the forensic examination of hairs or a current topic from the forensic literature that has been approved by the Section Chief that is of interest to the forensic community.

The trainee will field questions regarding their presentation topic as well as questions related to any/all aspects of their hair training.

18.8 Competency Evaluation and Mock Trial

18.8.1 As the trainee progresses through hair training, they will begin to process training sets as they would for casework to include drafting a Certificate of Analysis, as appropriate. There will be a minimum of three of these "case" files completed prior to issuance of the final competency test.

18.8.2 Using one or all of the "cases" from 18.8.1, the trainee will undergo a series of "mini-mock trial" practice sessions with qualified examiners from the Trace Evidence Section. It may be useful to include practice sessions with examiners from Sections other than Trace Evidence.

18.8.3 The trainee will be provided with a final competency test for analysis. This test will mimic actual casework to the maximum extent possible and will include at least one animal hair identification and one human hair classification of race, somatic origin and nuclear DNA suitability.

The trainee will analyze the final competency test samples and issue a Certificate of Analysis based upon their findings. The trainee will be called upon to defend their results via testimony in a formal mock trial setting. The mock trial will typically be scheduled about two weeks after the hair presentation and oral examination.

18.8.4 The trainer and the trainee will review the mock trial video tape in a timely fashion.

18.9 Certification

Upon successful completion of the training process, following Section 15.6 of the Division of Forensic Science, Quality Manual, the trainee will be issued a written certification memorandum.

18.10 Reading List

18.10.1 Appleyard, H.M., Guide to the Identification of Animal Fibers; Wool Industries Research Association: Leeds, England, 1978.

18.10.2 Brunner, H. and Coman, B., The Identification of Mammalian Hair, Inkate Press Proprietary Ltd., Melbourne, 1974.

18.10.3 Gaudette, B.D., and Keeping, E.S. , "An Attempt at Determining Probabilities in Human Scalp Hair Comparison", *Journal of Forensic Sciences*, July 1974, pp. 599-606.

18.10.4 Hicks, John, Microscopy of Hairs: A Practical Guide and Manual, Federal Bureau of Investigation, U.S. Government Printing Office, Washington, D.C., January 1977.

18.10.5 Houck, M. M. and Budowle, B., "Correlation of Microscopic and Mitochondrial DNA Hair Comparisons", *Journal of Forensic Sciences*, Vol. 47, No. 5, 2002, pp. 964-967.

18.10.6 Kirk, Paul L., Crime Investigation,, Interscience Publishers, Inc., New York, 1953.

18.10.7 Kirk, Paul L., "Human Hair Studies-General Considerations of Hair Individualization and its Forensic Importance", *Journal of Criminal Law and Criminology*, Vol. 31, 1941, pp. 486-496.

18.10.8 Linch, C.A., Smith, S.L. and Prahlow, J.A., "Evaluation of the Human Hair for DNA Typing Subsequent to Microscopic Comparison", *Journal of Forensic Sciences*, Vol. 43, No. 2, 1998, pp. 305-314.

18.10.9 Linch, C.A. and Prahlow, J.A., "Postmortem Microscopic Changes Observed at the Human Head Hair Proximal End", *Journal of Forensic Sciences*, Vol. 46, No. 1, 2001, pp. 15-20.

18.10.10 Moenssens, Andre A., Ray E. Mosses and Fred E. Inbau, Scientific Evidence in Criminal Cases, 3rd ed., The Foundation Press Inc., Mineola, New York, 1986.

18.10.11 Petraco, N. and Frass, C., "Morphology and Evidential Significance of Human Hair Roots", *Journal of Forensic Sciences*, Vol. 33, 1988, pp. 68-76.

18.10.12 Presley, Lawrence A. and Hensley, Kathryn W., "A Historical Review of Forensic Hair Comparisons", Federal Bureau of Investigation, Publication #88-01.

18.10.13 Saferstein, Richard, ed., Forensic Science Handbook, Volume 1, 2nd ed., Pearson Education, Inc., Upper Saddle River, NJ, 2002.

18.10.14 Wildman, A.B., "The Identification of Animal Fibers", *J. Forensic Science Society*, Vol. 1, No. 2, 1961, pp. 1-8.

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